

ENTOMOLOGY.—*On certain hymenopterous parasites of stored-grain insects.*¹ A. B. GAHAN, Bureau of Entomology. (Communicated by HAROLD MORRISON.)

The recent untimely death of my good friend and colleague, Dr. James Waterston of the British Museum, brought to an end a correspondence and in later years a warm personal friendship covering a period of more than ten years, during which time Dr. Waterston's whole-hearted and efficient cooperation was a source of very great helpfulness and pleasure to me. Shortly before his death in April, 1930, we became mutually interested in solving the identity of certain parasites of stored-grain insects and had made considerable progress when the project was interrupted. Fortunately the assistance of Dr. Ch. Ferriere, of the Imperial Bureau of Entomology, has made it possible to complete the investigation, in part at least, and the results which deal with certain species of Bethylidae are deemed worthy of publication at this time.

BETHYLIDAE

Plastanoxus westwoodi (Kieffer)

Figs. 1, 2, and 3.

Cephalonomia formiciformis var. Westwood, Trans. Ent. Soc. London, 1881, p. 127, pl. 6, fig. 4; male, female.

Cephalonomia westwoodi Kieffer, Das Tierreich, Bethylidae, 41 Lieferung, 1914, p. 248.

The species *Cephalonomia formiciformis*, which is type of the genus *Cephalonomia*, was described by Westwood in 1833² from specimens reared from a fungus growing in the neighbourhood of London. In 1833, Westwood republished the description and figured both sexes of the species. In his remarks he stated that he had received specimens of both sexes collected in Indian corn from Africa. In addition to figuring the winged and wingless forms of the female as well as the male of typical *formiciformis*, he published without further comment figures of the head, antenna, and wing of a male obtained from Indian corn. Apparently on the basis of Westwood's figures, Kieffer recognized the form from Indian corn as different from typical *formiciformis* and gave to it the name *Cephalonomia westwoodi* Kieffer.

Both the British Museum and the United States National Museum had accumulated a considerable number of specimens of Bethylidae reared from various lots of grain infested by beetles and some of this material obviously belonged to the genus *Cephalonomia*. Waterston found what he believed to be two species of this genus among his material and I discovered what I believed to be the same two forms in the material of the United States

¹ Received March 24, 1931.

² Mag. Nat. Hist., 6: 421, fig. 55. 1833; female.

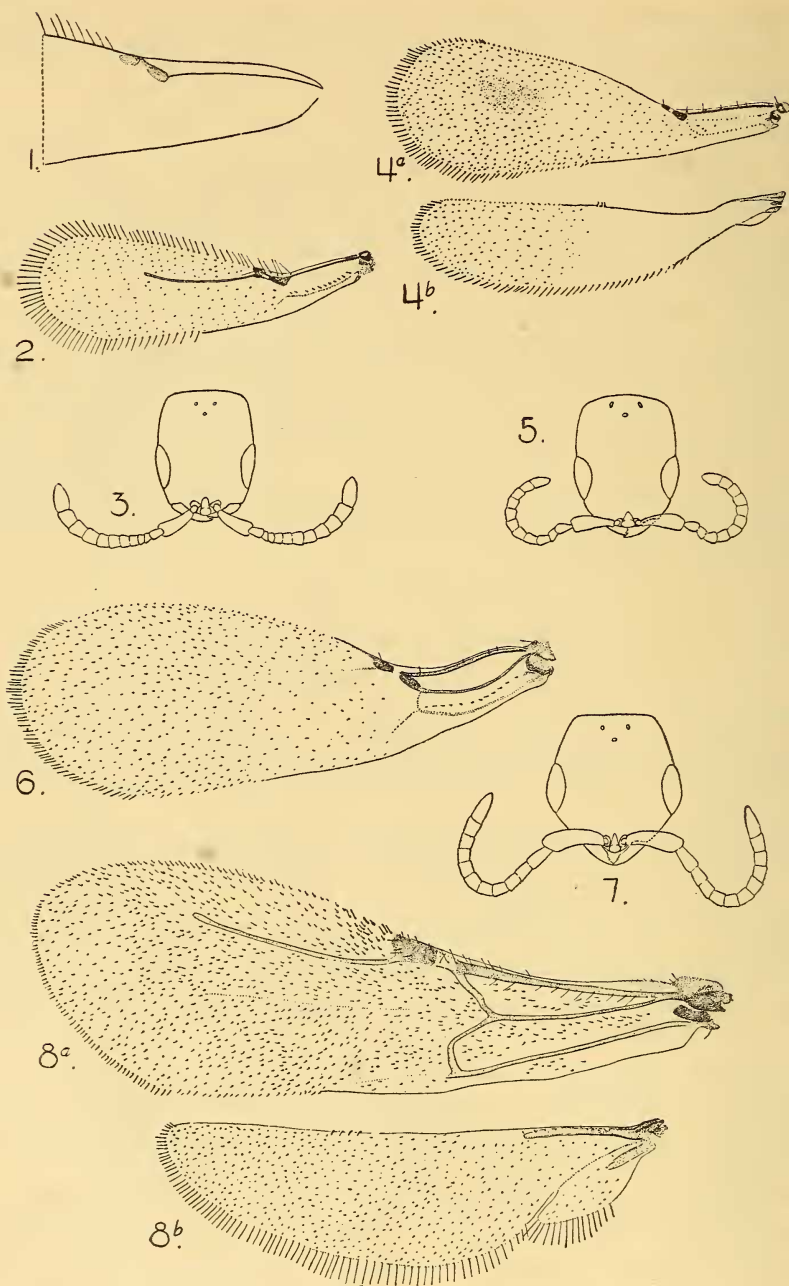


Fig. 1. Copy of Westwood's original figure of the wing of *Cephalonomia formiciformis*, variety from Indian corn, later named *Platanoxus westwoodi* by J. J. Kieffer.

Fig. 2. *Platanoxus westwoodi* (Kieffer). Forewing as it actually is.

Fig. 3. *Platanoxus westwoodi* (Kieffer). Head of female.

National Museum. One of these species we recognized as being *C. tarsalis* (Ashmead). The other seemed to agree rather closely with Westwood's figures and Kieffer's description of *C. westwoodi* Kieffer. In order to settle the identity of this species the writer suggested to Waterston that he endeavor to see the type of *C. westwoodi*, which was believed to be in the Hope Museum at Oxford. Through the cooperation of Prof. E. B. Poulton of Oxford the desired specimens were located and turned over to Waterston for study. The types, which were easily identified by the labels, consisted of two females and a single male mounted on cards. After a preliminary examination of these types Waterston wrote me in January, 1930, as follows: "I have struck rather a snag regarding *Cephalonomia*. There appears to be some slight difference between the antennae of the African type specimens and the examples which you and I have gathered. I am quite convinced, however, that our gatherings contain the same forms, and I shall send you my collection whenever I have come to a definite conclusion on the matter". In February he again wrote me, saying, "I have obtained permission from Prof. Poulton to send you one of the original examples of *Cephalonomia* first described by Westwood as a variety of the common British form and later described by Kieffer. I do not think that this Westwood material is identical with our gatherings but I should like you to see the insect and form your own opinion. I am also sending you my own grain-pest material of the genus which is quite comparable with the material you have been collecting. It may interest you to see what I have". This material arrived later in good shape and proved very interesting.

At first examination the Westwood specimen, a female, appeared to be a *Cephalonomia* but did not seem to agree with either of the two species of that genus represented in the grain-pest material before me. The specimen was glued to the card in such a way that the wing venation was only partly visible. By moistening one wing very slightly it was found possible to raise it from the card without detaching it from the specimen. When examined in its original position on the card, the venation appeared almost exactly as figured by Westwood, but when raised from the card it immediately became evident that this specimen at least had a long radial vein which was entirely lacking in the figure. Since the radial vein is lacking in typical *Cephalonomia* this specimen was run through Kieffer's key to the genera of Bethyilidae and found to run directly to *Plastanoxus* Kieffer, the genotype of which is *P. chittendeni* (Ashmead).

Fig. 4. *Cephalonomia waterstoni* Gahan. a, forewing; b, hind wing.

Fig. 5. *Cephalonomia waterstoni* Gahan. Head of female.

Fig. 6. *Cephalonomia tarsalis* (Ashmead). Forewing.

Fig. 7. *Cephalonomia tarsalis* (Ashmead). Head of female.

Fig. 8. *Rhabdepyris zeae* Waterston. a, forewing; b, hind wing.

All figures greatly enlarged. Drawings were made by ELEANOR A. CARLIN, artist of the Bureau of Entomology.

When compared with the types of *chittendeni*, which are in the United States National Museum collection, the specimen proved to be congeneric but a different species.

However, a review of Westwood's original remarks revealed the specific statement that his figures of the insect from grain were drawn from the male. The question then presented itself whether the male figured by Westwood (and therefore the holotype of the species) and the female examined by me were in reality the same species. Not having seen the male type I was in no position to answer this question. In the meantime Waterston's fatal illness developed and he passed away.

Fortunately Mr. Ch. Ferriere located the male specimen in question among other material on Waterston's desk, and he has recently informed me that he has compared this specimen with the female and found them to be specifically identical in venation as well as otherwise.

It is certain therefore that the figures by Westwood of the insect from Indian corn are incomplete (see Figs. 1 and 2) and that the so-called *Cephalonomia westwoodi* Kieffer is not a *Cephalonomia* but belongs in the genus *Plastanoxus*. The species is very similar to *Plastanoxus chittendeni* but may be easily distinguished. The following key will suffice to distinguish the three known species of the genus *Plastanoxus* Kieffer. Only *P. westwoodi* is known to be a parasite of stored-grain pests.³

KEY TO THE KNOWN SPECIES OF *Plastanoxus* KIEFFER

1. Forewing with median and submedian cells complete and distinct. Propodeum with a very distinct and complete median longitudinal carina. Radial vein extending fully two-thirds of the distance to wing-apex. *P. laevis* (Ashmead)
- Forewing with median and submedian cells effaced. Propodeum without longitudinal carina. Radial vein reaching less than two-thirds of distance to apex of wing.
2. Radial vein extending a little more than half the distance from its origin to the apex of wing; head of the female viewed from in front fully one and one-half times as long as broad, about 18:11, its sides nearly parallel; female antennae short, none of the flagellar joints except the apical one longer than broad, the first and second flagellar joints distinctly broader than long, apical joint ovate and nearly twice as long as broad; male head 13:12; male antennae longer than in the female, the flagellar joints except the first and second all slightly longer than broad, first and second nearly quadrate, apical joint twice as long as broad. Eyes in both sexes situated much nearer to the mouth than to the vertex. Pronotum distinctly more than twice as long as mesoscutum; propodeum twice as long as scutellum. *P. westwoodi* (Kieffer)
- Radial vein extending distinctly less than half the distance from its origin to apex of wing. (Female unknown.) Head of male scarcely longer than broad, about 15:14, its sides rounded; antennae longer, all

³ The species *Bethylus musculus* Say which is referred to *Plastanoxus* by Kieffer is known only from the original description. It may or may not belong here. It apparently differs from all of those included in the key by having the "feet honey-yellow."

flagellar joints distinctly a little longer than broad, the first and second not or scarcely shorter than the others, apical joint more than twice as long as broad. Eyes not or very little nearer mouth than vertex. Pronotum not twice as long as mesoscutum; propodeum not quite twice as long as scutellum. *P. chittendeni* (Ashmead)

Plastanoxus kiefferi is a slender species, 1 to 1.25 mm. in length, wholly black except the tarsi which are yellowish; head wholly smooth, impunctate, and shining; pronotum, mesoscutum, and scutellum also polished, parapsidal grooves absent; propodeum longer than broad, finely and distinctly punctate

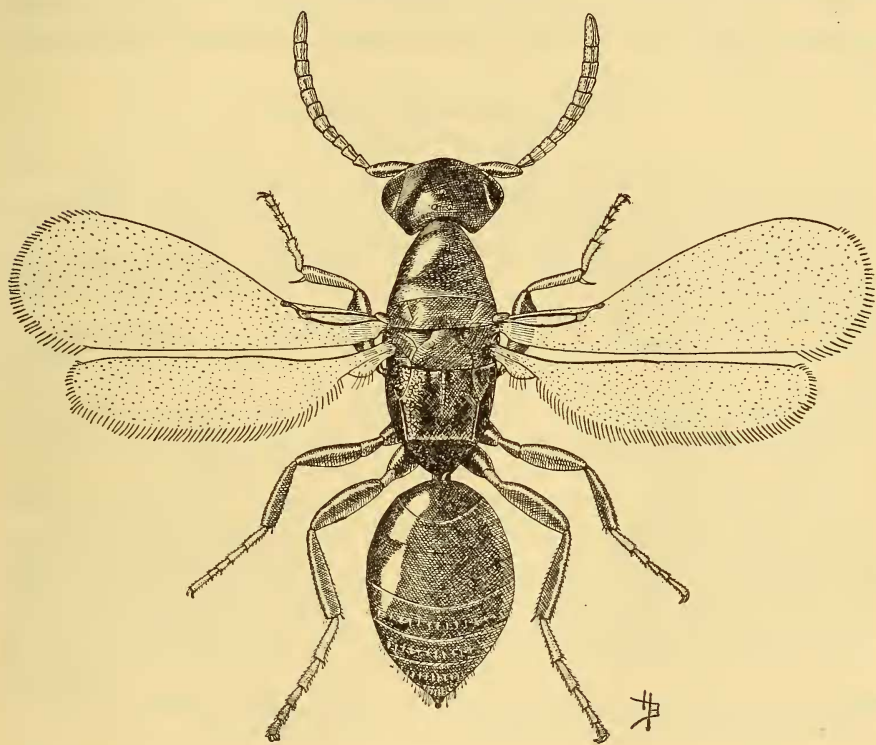


Fig. 9.—Adult female of *Cephalonomia tarsalis* Ashmead. (Greatly enlarged.) Drawing by H. BRADFORD.

basally, the dorsal apex mostly polished; abdomen practically smooth, the tergites beyond the first very faintly reticulated.

In addition to the type female already mentioned, the writer has seen the following material: Fourteen specimens (2 males and 12 females) in the United States National Museum, reared at Washington, D. C., from the pupal cell of *Laemophloeus* (*Cryptolestes*) *pusillus* Schönherr, by R. T. Cotton March 16, 1925; one male in the British Museum tentatively identified by Waterston as *Cephalonomia* sp. in Reports of the Grain-Pests (War) Commit-

tee, No. 9, and shown in that report (see page 51, No. 324) to have been collected at Plymouth, England, from a shipment of grain from Sydney, Australia, which was infested by several different species of beetles, one of which was the species above named; one previously unidentified specimen, also in the British Museum, bearing the number 381, which number undoubtedly refers to the shipment of grain mentioned in the above-named report (see page 48, No. 381) as having been received at Sunderland, England, from Freemantle, Western Australia, and which was likewise infested by several species of beetles of which *L. pusillus* was one.

Apparently then *P. westwoodi* is a widely distributed species, probably occurring in Africa, Australia, and North America, and parasitic upon *Laemophloeus pusillus*.

***Cephalonomia tarsalis* (Ashmead)**

Figs. 6, 7 and 9.

Ateleopecterus tarsalis Ashmead, Bul. U. S. Nat. Mus., 45: 45. 1893.

Neoscleroderma tarsale Kieffer, in Wytzman's Gen. Ins., 76: 41. 1908.

Neoscleroderma tarsale Kieffer, Das Tierreich, 41: 270. 1914.

Neoscleroderma tarsalis Brues, Conn. Geol. Nat. Hist. Surv. Bul. 22, Hymenoptera, 1917, p. 610.

Neoscleroderma tarsalis Washburn, 17th Rept. Sta. Ent. Minn., 1918, p. 205.

Cephalonomia kiefferi Fouts, Proc. Ent. Soc. Wash., 22: 71. 1920.

Ateleopecterus tarsalis Back and Cotton, Jour. Agr. Res., 33: 449. 1926.

? *Cephalonomia* sp. Myers, Bul. Ent. Res., 20: 428. 1929.

Cephalonomia tarsalis Gahan, Proc. U. S. Nat. Mus., 77: 11, art. 8. 1930.

This species, although closely resembling the following new species, is easily distinguished from it by the presence of a complete and distinct median cell in the forewing (Pl. I, Fig. 6). It is also slightly larger, the head is not parallel-sided but distinctly broader at middle than at either vertex or mouth, the eyes are situated at or very near the middle of head, the antennae of female longer with at least the 10th and 11th joints slightly longer than broad and the 12th about two and one-half times as long as broad.

Female.—Length 1.7 to 2 mm. Shining black, the antennal scape black, flagellum brown to brownish black, all tarsi and usually the anterior tibiae reddish yellow; wings hyaline, the venation brownish.

Head pronotum, mesoscutum, and scutellum with fine shallow reticulate-punctate sculpture; propodeum dorsally very distinctly and nearly uniformly reticulate-punctate and with a very distinct and usually complete median longitudinal carina; abdomen as long as thorax, ovate, smooth, the third, fourth, and fifth tergites each with an arcuate depression before the apex, this depressed area defined anteriorly by more or less of a ridge which is more prominent laterally than at middle.

Male.—Similar in every way to the female except that the antennae are entirely black, more slender than in female, joints 3 to 11 each twice or nearly twice as long as broad, joint 12 three times as long as broad; abdomen shorter than the thorax, ovate.

Redescribed from the types and 40 additional specimens in the United States National Museum.

Cephalonomia tarsalis was originally described from specimens reared from *Oryzaephilus surinamensis* (Linnaeus) collected at Lafayette, Indiana, and Washington, D. C. The above cited references by Kieffer, Brues, and Washburn are for the most part merely repetitions of this original record. Back and Cotton record the species from Washington, D. C., reared from the same host and also from Texas from an unidentified host. The types of *C. kiefferi* Fouts, which species was synonymized with *tarsalis* by Gahan in 1930, were reared from *Sitophilus oryzae* (Linnaeus) at Wellington, Kansas. The national collection contains specimens reared from *O. surinamensis* at Vienna, Virginia, by R. A. Cushman, and from Columbus, Ohio, by O. E. Gahm. Other specimens without definite host records are from Fresno, California, collected by J. C. Hamlin, Sept. 24, 1924, and W. D. Reed, Sept. 7, 1925; Saticoy, California, S. E. Flanders; Bozeman, Montana, R. A. Cooley; and Agricultural College, Michigan, D. B. Whelan. I have also seen numerous specimens, now in the British Museum, collected from shipments of infested grain during the World War and listed in Reports of the Grain Pests (War) Committee, No. 9, 1921, pp. 50-52, under the name *Cephalonomia* sp. and comprising lots numbers 201, 206, 222, 324 (in part), 358, 371, 378, 382, and 387 as there enumerated. All of these shipments of grain seem to have originated in Australia and in practically every instance either *Oryzaephilus surinamensis* or *Sitophilus oryzae* were found to be present in the shipment. In most instances both of these species were present along with other species of Coleoptera which infest stored grain.

It appears certain from the above records that *C. tarsalis* occurs in both Australia and North America and it seems highly probable that it will be found to be practically cosmopolitan. The records show only *Oryzaephilus surinamensis* and *Sitophilus oryzae* definitely established as hosts of the species but it is not improbable that other related grain-infesting beetles may be attacked.

The interesting account by J. G. Myers of *Cephalonomia* sp. attacking *Silvanus* in Australia, cited above, very probably involves this species and may also involve the following species. Myers states that Waterston recognized the species as identical with the species collected by the Grain Pests (War) Committee. Waterston, I believe, was not aware at that time that this material included two species and it is impossible to tell from Myers's account which species he had under observation.

Cephalonomia waterstoni, new species

Figs. 4 and 5

Readily distinguished from *C. tarsalis* by the absence of a complete median cell in the forewing, the more nearly parallel-sided head, and the fact that the eyes are situated below the middle of the head.

Female.—Length 1.6 mm. Black and shining; mandibles, pedicel, and first flagellar joint more or less, and all tarsi yellowish; antennal flagellum and the tibiae brownish black; wings hyaline or with a very faint discal cloud. Head viewed from in front longer than broad (20:16), the sides nearly parallel or very slightly convex; eyes situated much nearer to mouth than to vertex, about their own length below vertex; ocelli distinct, in an equilateral triangle; whole head finely reticulate-punctate. Antennae inserted at clypeus, 12-jointed; scape two and one-half to three times as long as broad, pedicel about one and one-half times as long as broad, joints 3 to 11 subquadrate, joint 12 about twice as long as broad. Thorax flattened dorsally and with reticulate-punctate sculpture like the head; pronotum about three times the length of mesoscutum, much narrower anteriorly than posteriorly; mesoscutum without longitudinal grooves; scutellum distinctly longer than mesoscutum, with a short groove or pit on either side of base; propodeum flat, in the same plane as scutellum, as long as pronotum, distinctly narrower at apex than at base, sculptured like the thorax, finely margined laterally and at apex of dorsum, a very delicate median longitudinal carina present or absent, the lateral and posterior faces sculptured like the dorsum. Wings (see Pl. I, Fig. 5) well-developed, the prostigma and pterostigma very small, other veins except the submarginal effaced, the forewing without basal cells. Legs normal, the femora moderately swollen, the hind tarsi longer than their tibiae. Abdomen ovate, a little broader than the thorax and subequal to it in length, smooth and polished, the third tergite with a barely perceptible suggestion of a depression on each side of the middle.

Male.—Unknown.

Type-locality.—Australia.

Type.—Cat. No. 43361, U. S. N. M.

Described from 11 female specimens taken at quarantine in Washington, D. C., by E. A. Back from a shipment of grain the original source of which was said to be Australia; also four females collected from stored corn at Baton Rouge, Louisiana, November 12, 1928, by C. O. Hopkins, and bearing Louisiana Agricultural Experiment Station No. 1511; also one female taken at Urbana, Illinois, January 26, 1927, by W. V. Balduf.

I have likewise seen numerous specimens now in the British Museum, the same being those listed in the Royal Society's 9th Report of the Grain Pests (War) Committee, 1921, listed under the name *Cephalonomia* sp. (p. 50) and comprising the lots numbered 247, 262, 266, 347, 348, 349, 370, 384, 386, 389, and 390 of that report. According to that report one or more of the following species of Coleoptera were present in each of these shipments of grain: [*Calandra*] *Sitophilus oryzae* (Linnaeus), [*Calandra*] *Sitophilus granaria* (Linnaeus), *Tribolium castaneum* (Herbst), *T. confusum* Duval, *Rhizopertha dominica* (Fabricius), [*Silvanus*] *Oryzaephilus surinamensis* (Linnaeus), *Laemophloeus pusillus* (Schönherr), *Anthicus floralis* (Linnaeus), *Carpophilus dimidiatus* (Fabricius), *Tenebroides mauritanicus* (Linnaeus), and [*Cathartus*] *Ahasverus advena* (Waltl).

The species has not been associated with any definite host but is in all probability parasitic upon one or more of the Coleoptera which infest stored grain. It is apparently established in Australia and North America and probably occurs elsewhere.

As pointed out in discussion of *C. tarsalis*, the account by J. G. Myers of *Cephalonomia* sp. in Australia may possibly involve this species.

Cephalonomia meridionalis Brèthes

Cephalonomia meridionalis Brèthes, An. Mus. Nac. Hist. Nat. Buenos Aires, 24: 87. 1913.

This species is unknown to the writer. It is said to be parasitic upon [*Silvanus*] *Oryzaephilus surinamensis* (Linnaeus) in Argentina.

It apparently differs from both of the foregoing species by having the coxae testaceous.

Cephalonomia sp.

Cephalonomia sp. Grandi, Bol. Lab. Ent. R. Ist. Super. Agr. Bologna, 2: 301-314, figs. 1-9. 1929.

Grandi describes and figures a species reared from *Sitodrepa panicea* Linnaeus in Italy as *Cephalonomia* sp. He was unable to identify this insect specifically.

This species is evidently different from either *C. tarsalis* or *C. waterstoni*. The head resembles that of *waterstoni*, but the venation is more reduced, the prostigma and pterostigma apparently effaced in the alate male, while the female is wingless.

Rhabdepyris zeae Waterston

Rhabdepyris zeae Waterston, 9th Rept. Grain Pests (War) Committee, Roy. Soc. Lond., 1921, p. 27, figs. 14 and 15; Gahan, Proc. U. S. Nat. Mus., 77: 12, art. 8. 1930.

Originally described from a specimen taken at Liverpool, England, in a shipment of grain from Africa. The writer has recently recorded its occurrence in stored grain at Lafayette, Indiana, and Baton Rouge, Louisiana, as a probable parasite of *Tribolium confusum*. Five specimens more recently received were reared from stored grain at Brownwood, Texas, by J. L. Gardiner.

The wings of this species are figured for comparison with the other species (see Pl. I Fig. 8).

Parepyris sylvanidis Brèthes

Parepyris meridionalis Brèthes, An. Mus. Nac. Hist. Nat. Buenos Aires, 24: 87. 1913.

This species is unknown to me. It is said to be parasitic upon [*Silvanus*] *Oryzaephilus surinamensis* in Argentina.

Parepyris is characterized by Brèthes as a new and monobasic genus. At about the same time Kieffer (Boll. Lab. Zool. Portici, 7: 108. 1913) proposed *Parepyris* as a new genus with *Epyris interruptus* Kieffer as the genotype. *Parepyris* Kieffer and *Parepyris* Brèthes are apparently different genera but the writer is unable at present to determine which has priority, as the exact date of publication of Kieffer's paper is not clear.